REMARKS

INTRODUCTION

In accordance with the foregoing, claim 30 has been cancelled. Claims 1, 3, 4, 7, 9, 13, 15-21 and 25 are pending and under consideration.

CLAIM REJECTIONS

Claims 1, 3, 4, 7, 9, 10, 15-21, 25 and 30 were rejected under 35 USC 102(b) as being anticipated by Hakala (US 5,847,533) (hereinafter "Hakala").

Hakala discusses a procedure and apparatus for braking a synchronous motor. In Hakala, connected between conductors 22 and 24 in the intermediate circuit of the frequency converter are braking resistors 58 and 60 in series with a braking transistor 62. During normal operation, control unit 46 controls transistor 62 in such a way that the power generated by the motor is at least partially consumed in the braking resistors. Braking resistor 58 is a normal braking resistor used to consume the returning power. Braking resistor 60 has a non-linear voltage-current characteristic as shown in FIG. 2. Its resistance is larger for high voltage values than for low voltages, corresponding to the use of a metallic resistor subject to heating as e.g. in the incandescent bulb. In other words, a resistor is used in which a rise in temperature increases its resistance in the operating range. The braking resistor may also be a positive temperature coefficient (PTC) resistor or a voltage dependent (VDR) resistor. Hakala, 2:48-2:63 and Figure 1.

Further in Hakala, dynamic braking is activated when the system detects an anomalous operating condition, such as a break in the power supply, or an overspeed condition in which an overspeed governor is triggered. At the same time, contactor 64 is closed, with the consequence that the stator circuit of the motor is closed via supply conductors 38, 40 and 42, diodes 52-57 and the non-linear resistor 60. The contactor is controlled by the electromotive force generated in the motor windings. The frequency converter 3 is preferably disconnected from the mains by means of the mains switch 20. If the motor is running at a high speed at the instant the contactor 64 is closed, e.g. when the overspeed governor is triggered, then the voltage across the resistance is high and, correspondingly, the resistance 60 is also high, so that the current and

therefore the braking torque is limited to the maximum value thus determined. If it is assumed that the relative value V/[pu] (pu=per unit) of the voltage corresponds to full speed at its value 1.0, and the relative value i/[pu] of the current corresponds to acceleration at its value 1.0, then it can be assumed that the balanced torque for full load is about 1/3. In the case of a linear resistor, the speed would be about 33%, whereas in the case of a non-linear resistor the speed is about 17%. Hakala, 3:6-3:29 and Figures 1 and 2.

Further in Hakala, the resistor used in the above example is the type of assistance element found in an incandescent lamp. In this case, a current peak may occur at the instant the connection is made. This can be obviated by initially connecting a linear resistor in series with the non-linear resistor 60. This is implemented using a normal braking resistor 58 and a transistor 62 to connect it. During normal operation, resistors 58 and 60 and the braking transistor 62 are used to control braking. Hakala, 3:30-3:39 and Figure 1.

Still further in Hakala, braking resistor 60 can be replaced with a number of resistors in series that are shorted by respective contactors as the speed changes. In this case the non-linearity in the resistance value is determined on the basis of the control of the contactors. Hakala, 3:40-3:45.

In another embodiment of Hakala, the synchronous motor 2 is fed by a frequency converter 70. The converter 70 is connected to the supply mains and to the motor 2. The frequency converter 70 is controlled by a control unit 146 generating control pulses that are passed via conductors 151 to the switches in the frequency converter 70. By means of a contactor 84, star-connected non-linear resistors 78, 80 and 82 are connected to the output terminals of the frequency converter. Contactor 84 is controlled by the control unit 146 in a manner corresponding to the control of contactor 64. In this embodiment, dynamic braking thus occurs completely outside the frequency converter. Hakala, 3:62-4:8 and Figure 3.

Claims 1, 3 and 4

Claim 1 recites: "...a switching controller turning on and turning off one of the first and second switching units provided in respective opposite ends of the inverting part so that the overcurrent consumed by the brake resistors is changeable in proportion to a rotation speed of the motor, when the brake relays short circuit the plurality of motor windings..." In the Office Action, the Examiner relies on control unit 46, shown in Figure 1 of Hakala, and control unit 146,

shown in Figure 3 of Hakala, to supply this feature of claim 1.

Regarding control unit 46 shown in Figure 1 of Hakala, in contrast to the switching controller of claim 1, control unit 46 of Hakala controls transistor 62 so that power generated by the motor is at least partially consumed in the braking resistors 58 and 60. Braking resistor 58 is a normal braking resistor used to consume the returning power. Braking resistor 60 has a non-linear voltage-current characteristic, an example of which is shown in Figure 2. As such, control unit 46 controls the overcurrent not by turning on/off one of the first and second switching units provided in respective opposite ends of the inverting part, but rather by the use of non-linear braking resistor 60. In conjunction with control unit 46 of Hakala, it is discussed that braking resistor 60 can be replaced with a number of resistors in series that are shorted by respective contactors as the speed changes. However, braking resistors 58 and 60 are still connected in series with a braking transistor 62 connected between conductors 22 and 24 in the intermediate circuit of the frequency converter, and it is not discussed to turn on/off one of first and second switching units provided in the inverting part as recited in claim 1.

Regarding control unit 146 shown in Figure 3 of Hakala, in contrast to the switching controller of claim 1, control unit 146 of Hakala controls a contactor 84 wherein dynamic braking occurs completely outside the frequency converter. Hakala, 4:5-4:8 and Figure 3. As such, it is respectfully submitted that the control unit 146 of Hakala does not discuss the switching controller of claim 1 since the switching controller of claim 1 turns on/off switching units provided in the inverting part. By contrast, Hakala discusses an apparatus and procedure where the dynamic braking occurs completely outside the frequency converter.

Claims 3 and 4 depend on claim 1 and are therefore believed to be allowable for at least the foregoing reasons.

Withdrawal of the foregoing rejection is requested.

Claims 7 and 9

Claim 7 recites: "...turning on and turning off one of the first and second switching units provided in respective opposite ends of the inverting part so that the overcurrent consumed by the brake resistors is changeable according to a rotation speed of the motor..." In the Office Action, the Examiner relies on control unit 46, shown in Figure 1 of Hakala, and control unit 146, shown in Figure 3 of Hakala, to supply this feature of the method of claim 7.

Regarding control unit 46 shown in Figure 1 of Hakala, in contrast to turning on/off the switching units of claim 7, control unit 46 of Hakala controls transistor 62 so that power generated by the motor is at least partially consumed in the braking resistors 58 and 60. Braking resistor 58 is a normal braking resistor used to consume the returning power. Braking resistor 60 has a non-linear voltage-current characteristic, an example of which is shown in Figure 2. As such, control unit 46 controls the overcurrent not by turning on/off one of the first and second switching units provided in respective opposite ends of the inverting part, but rather by the use of non-linear braking resistor 60. In conjunction with control unit 46 of Hakala, it is discussed that braking resistor 60 can be replaced with a number of resistors in series that are shorted by respective contactors as the speed changes. However, braking resistors 58 and 60 are still connected in series with a braking transistor 62 connected between conductors 22 and 24 in the intermediate circuit of the frequency converter, and it is not discussed to turn on/off one of first and second switching units provided in the inverting part as recited in claim 7.

Regarding control unit 146 shown in Figure 3 of Hakala, in contrast to turning on/off the switching units of claim 7, control unit 146 of Hakala controls a contactor 84 wherein dynamic braking occurs completely outside the frequency converter. Hakala, 4:5-4:8 and Figure 3. As such, it is respectfully submitted that the control unit 146 of Hakala does not discuss turning on/off the switching units of claim 7. By contrast, Hakala discusses an apparatus and procedure where the dynamic braking occurs completely outside the frequency converter.

Claim 9 depends on claim 7 and is therefore believed to be allowable for at least the foregoing reasons.

Withdrawal of the foregoing rejection is requested.

Claims 13, 15-21 and 25

Claim 13 recites: "...a plurality of switching units to supply AC power to the motor; brake resistors, respectively, connected to the plurality of motor windings to exhaust power from an overcurrent generated by the motor; and a controller to control selected ones of the plurality of switching units so that the power exhausted by the brake resistors corresponds to a rotation speed of the motor..." In the Office Action, the Examiner relies on control unit 46, shown in Figure 1 of Hakala, and control unit 146, shown in Figure 3 of Hakala, to supply the controller of claim 13.

Regarding control unit 46 shown in Figure 1 of Hakala, in contrast to the controller of claim 13, control unit 46 of Hakala controls transistor 62 so that power generated by the motor is at least partially consumed in the braking resistors 58 and 60. Braking resistor 58 is a normal braking resistor used to consume the returning power. Braking resistor 60 has a non-linear voltage-current characteristic, an example of which is shown in Figure 2. As such, control unit 46 controls the overcurrent not by selecting one of the switching units, but rather by the use of non-linear braking resistor 60.

Regarding control unit 146 shown in Figure 3 of Hakala, in contrast to the controller of claim 13, control unit 146 of Hakala controls a contactor 84 wherein dynamic braking occurs completely outside the frequency converter. Hakala, 4:5-4:8 and Figure 3. As such, it is respectfully submitted that the control unit 146 of Hakala does not discuss the controller of claim 13 since the controller of claim 13 controls switching units that supply AC power to the motor. By contrast, Hakala discusses an apparatus and procedure where the dynamic braking occurs completely outside the frequency converter.

Claims 15-21 and 25 depend on claim 13 and are therefore believed to be allowable for at least the foregoing reasons.

Withdrawal of the foregoing rejection is requested.

Claim 30

Claim 30 has been cancelled.

CONCLUSION

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

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By: Gregory W. Harper
Gregory W. Harper
Registration No. 55,248

1201 New York Avenue, NW, Suite 700
Washington, D.C. 20005
Telephone: (202) 434-1500
Facsimile: (202) 434-1501